own desire, he undertook the particular investigation which he was completing at the time of his death. Though a man of gentle disposition, and very modest in his demeanour, Haward undoubtedly was conscious in the right way of his experimental powers, which excited the daily admiration of those whose privilege it was to watch their rapid development. He had in a marked degree the instinct of the true artist, which was never satisfied with anything less than the best. He was twenty-six years of age, and was married only fifteen months ago.

ANOTHER Kew veteran has passed away in the person of JOHN READER JACKSON, who died on October 28 at his house at Lympstone, near Exmouth, Devon, aged eighty-three. Mr. Jackson was born in 1837 at Knightsbridge, but his family removed about 1843 to Canterbury, where he received his early education, returning in 1851 to school in London. Through the influence of Prof. Thomas Bell, then president of the Linnean Society of London, he was given charge of the museums at Kew, then in process of development under Sir William Hooker, and for nearly twenty years he discharged his duties single-handed, until in 1879 he received the help of an assistant. His work left him but little time for literary diversion, but we owe to him not a few contributions in applied botany in various journals, as in those of the Linnean and Pharmaceutical Societies, the *Technologist, Gardeners' Chronicle,* and the like. Mr. Jackson brought out a new edition of Barton and Castle's "British Flora Medica" in 1877, and in 1890 appeared his excellent "Commercial Botany of the Nineteenth Century." He was elected an associate of the Linnean Society in 1868, and was the senior on the list at the time of his death.

WE regret to record the death of DR. CHARLES INFROIT, late head of the radiological service at the Salpêtrière Hospital, Paris. The death of Dr. Infroit adds one more to the list of victims to X-ray dermatitis. A pioneer in the subject of X-rays in medicine, he was injured through over-exposure to the rays at a time when these dangers were not fully appreciated. Despite the disabilities by which he was handicapped, he made numerous contributions to the literature of the subject of radiology, especially from the diagnostic side. So recently as last year a paper appeared by him on the subject of concretions in the lung simulating the presence of a foreign body. A joint communication with Pascalis upon the surgery of the bones of the head appeared in the *Journal de Chirurgie,* 1912. Dr. Infroit designed and put into use a localiser of foreign bodies, which was used very considerably during the war; details of this instrument and the results obtained by its use may be found in the *Bulletin de l'Académie de Médecine,* 1915.

NEWS has just been received of the death of HOFRAT ALEXIUS MEINONG, on November 27, after a short illness, at the age of sixty-seven. Professor of philosophy at the University of Graz, to which he was appointed in 1889, Meinong was well known to philosophical students throughout the world by his important contributions to a special branch of study which he named "Gegenstandstheorie." His earliest published work was "Hume Studien," 2 vols., 1877. His principal work, and that by which he is best known, is entitled "Ueber Abnahmen," published in 1902, and a second edition of which appeared in 1910.

WE regret to announce the death, on December 13, at seventy-two years of age, of DR. ALEXANDER MUIRHEAD, F.R.S.

Notes.

THE position of scientific men employed in the Government service has long exercised the minds of scientific workers. The responsibility for the National Physical Laboratory and for the Geological Survey has been handed over to the Department of Scientific and Industrial Research. Kew is still under the Ministry of Agriculture and Fisheries. The Government Chemical Laboratory and the British Museum, with its Natural History Branch at South Kensington, remain distinct institutions for which the Treasury is responsible. All these institutions are largely concerned with the preservation and routine examination of specimens, testing, and the standardisation of methods, and do not serve solely for research. The Ministry of Agriculture has farmed out its research work to institutions such as Rothamsted, the Imperial College of Science and Technology, Cambridge and Oxford, etc.; it still retains, however, on its fisheries side a Research Division. Dissatisfaction has long been felt at the positions, rates of pay, and prospects of promotion in all these offices. Scientific men claim that the positions offered to them should be at least equal in rank, in prospects, and in pay to those offered in the regular Civil Service. The matter came up for discussion at the meetings of several Sections of the British Association at Cardiff. It was referred to the council of the Association, which has now unanimously passed the following resolution and forwarded it to the First Lord of the Treasury:—"That the council considers that no scheme of payment of professional scientific men in the service of the State is satisfactory which places them on a lower level than that of the higher grade of the Civil Service." It is clear that the Treasury must agree with this resolution if the services of scientific men of the first grade are to be obtained for research purposes.

IN addition to revolutionising the methods of wireless telegraphy and rendering possible the practical development of wireless telephony, the thermionic valve promises to have a far-reaching effect on long-distance line telephony in furnishing a telephonic relay of remarkable powers. On long lines considerable difficulties are caused by attenuation of the current-waves and distortion of their form in transmission. Sufficient audibility could be obtained only by going to commercially impracticable expense in the provision of copper in the line, and sufficiently true reproduction of the wave-form for recognisable speech could be reached only by loading the line with artificial inductance to counteract its natural capacity. It is true that various forms of telephone relay have been experimented with from time to time in the endeavour to diminish the amplitude of the current-waves necessary to an extent which would bring the cost of copper within reasonable limits, and at the same time to lessen the troubles due to distortion, but until the advent of the thermionic valve no instrument was found which combined the requisite ratio of amplification with truthfulness of reproduction. A set of thermionic telephone repeaters working on an artificial cable circuit is being demonstrated at the office of the Western Electric Co. at 62 Finsbury Pavement, E.C.2, which represents the state of development arrived at by this company in conjunction with the American Telegraph and Telephone Co. It is interesting to notice in the next column of the *Times* to that in which appears the announcement of this demonstration an account of another example of the use of the thermionic valve in a wireless telephone demonstration between Geneva and London organised by the Marconi Co.

The following are the lecture arrangements at the Royal Institution before Easter of next year:—Prof. J. Arthur Thomson, a course of lectures on The Haunts of Life, adapted to a juvenile auditory, to begin on December 30; Sir Gerald P. Lenox-Conyngham, two lectures on The Progress of Geodesy in India; Sir James G. Frazer, three lectures on Roman Life (Time of Pliny the Younger), London Life (Time of Addison), and Rural English Life (Time of Cowper); Dr. Arthur Keith, four lectures on Darwin's Theory of Man's Origin; Dr. W. A. Herdman, three lectures on Oceanography; Mr. F. Balfour Browne, two lectures on Mason Bees and Wasps; Dr. G. C. Simpson, two lectures on The Meteorology of the Antarctic; Dr. Percy C. Buck, three lectures on The Madrigal, with musical illustrations by the English Musical Singers; Prof. A. Fowler, three lectures on Spectroscopy; and Sir Ernest Rutherford, three lectures on Electricity and Matter. The Friday evening meetings will commence on January 21, when Sir James Dewar will deliver a discourse on Cloudland Studies. Succeeding discourses will probably be given by Sir Frank Benson, Dr. A. D. Waller, Dr. F. W. Aston, Mr. Solomon J. Solomon, Dr. John Buchan, and Sir Frederick Bridge, among others.

The meeting of the American Ornithologists' Union in Washington, D.C., on November 8–11, was one of the largest in the history of the union. The election of officers for 1921 resulted as follows:—*President:* Dr. Witmer Stone, Philadelphia. *Vice-Presidents:* Dr. G. B. Grinnell and Dr. J. Dwight, New York. *Secretary:* Dr. T. S. Palmer, 1939 Biltmore Street, Washington, D.C. *Treasurer:* Mr. W. L. McAtee, Biological Survey, Washington, D.C. The single vacancy in the council was filled by the selection of Dr. W. H. Osgood, of Chicago. The programme of nearly forty papers, five of which were illustrated by motion pictures, covered a wide range of subjects relating to North American birds, and also included papers on the birds of Argentina, Nicaragua, Peru, Europe, and Madagascar. In connection with the meeting an exhibition of drawings, paintings, and photographs of birds by American artists, supplemented by a series of prints showing the development of zoological illustration as applied to birds from the earliest times down to date, was arranged in the division of prints in the Library of Congress.

In the House of Commons on December 8 Sir Philip Magnus asked the Prime Minister:—"Whether, having regard to the urgent necessity of securing for laboratory and other purposes a sufficient supply of the different kinds of glass used in the manufacture of optical and other instruments, and having regard to the importance of encouraging the production in this country of such glass, he will arrange for the introduction at an early date of a Bill prohibiting for a time, except under special licence, the importation of such varieties of glass and of such scientific instruments as may or can be produced in this country?" Sir Philip Lloyd-Greame, who replied, said that the President of the Board of Trade had stated during the debate on December 7 that the Government intends to introduce the Bill dealing with key industries, other than the dye industry, as the first measure next session.

The four hundredth anniversary of the discovery of the Straits of Magellan is to be celebrated this month. According to the *Scientific Monthly* for November the festivities will centre in Santiago and Punta Arenas, where the occasion will be marked by the inauguration of several important public works, including port improvements, lighthouses in Smith Channel, and the laying of the foundation-stone of the University of Punta Arenas. Great Britain, Spain, Portugal, and the nations of America are to be invited to join Chile in the commemoration of the anniversary.

The *Times* of December 15 publishes a communication from its Paris correspondent describing a paper read before the French Academy of Sciences on the use of X-rays for the examination of old paintings, and the message refers to a picture by an old Dutch master in which a woman had been painted in over the picture of a monk. There is, however, nothing new in the report given in the *Times*, and this particular application of X-rays was described and illustrated in NATURE of February 26 last (vol. civ., p. 699).

In a letter published in NATURE of September 30 Mr. C. S. Garnett gave an account of some interesting mineral deposits which had been investigated by him in Derbyshire. It is now announced that three miles south of Matlock, near Wirksworth, Mr. Garnett has discovered a new deposit of fluorspar which is reported to be a mile in extent and 30 ft. in thickness.

The thirty-third annual Report of the Bureau of American Ethnology for 1911–12, published in 1919, shows no evidence of the effects caused by the war on many scientific societies in Europe. The activities of American anthropologists continue unabated, and the format of the report, with its abundant illustrations, is fully up to the pre-war standard. One of the most important investigations carried on by the Bureau is the transcript by Mr. F. W. Hodge, the Ethnologist-in-Charge, of a series of inscriptions recorded by the early Spanish explorers on El Morro, or Inscription Rock, in the Zuni district, which have an important bearing on the early history of the Pueblo tribes. Opportunity was taken to explore an interesting Pueblo site in the Jemez Valley. It was the custom of the inhabitants to throw large stones into the graves of the dead, thus destroying the pottery deposited with the remains. Numerous fragments discovered will enable these jars to be reconstructed. It is satisfactory to learn that the progress made by Mr. W. H. Holmes in compiling his "Handbook of Archæology" has been satisfactory.

The *Museums Journal*, recently compelled to double its price, has managed to set against this an increase in the number of pages and plates and the enlistment of high authorities in its staff of reviewers. The improvement seems particularly marked in the domains of art, archæology, and cultural anthropology. The educational use of museums has been much discussed of late by the Museums Association, and the December issue of the journal contains an article, "The Child and the Mummy," by Mr. Peart, Director of Education for the City of Winchester, who suggests ways in which the dead objects in a museum may be made more alive for younger pupils. He would permit some handling, would add colour to backgrounds and labels, would connect the demonstration with knowledge already possessed by the child, and would lay stress on the human associations of each specimen—the romance of collecting and so forth. In the same issue Mr. Charlton Deas pleads for "an Imperial Department of Illustrated Public Information"—the home propaganda of war-time continued in peace.

The report on the Government Museum at Madras for 1919–20 has just been received. The new superintendent, Dr. F. H. Gravely, announces a large number of additions to the archæological collections, chiefly in the form of copper-plate grants. Among these the most interesting is a set of thirty-one found in an underground chamber at the temple of Tiruvēlāngādu, Chittoor district, and recording the grant to that temple of the village of Palaiyanūr by King Rājēndra-Chōla in A.D. 1016. A sword-fish, *Histiophorus brevirostris*, 5 ft. 1 in. in length, has lately been procured. The specimen 4 ft. 4 in. long mentioned by F. Day ("Fauna of British India," Fishes, vol. ii., p. 133) has disappeared from the museum, and it would be interesting to know where it now is.

The Wistar Institute of Anatomy and Biology (36th Street and Woodland Avenue, Philadelphia) issues abstract library cards, of standard size for card-catalogues, of all papers appearing in the *Journal of Morphology*, the *Journal of Experimental Zoology*, the *American Journal of Physical Anthropology*, and the six other periodicals which it publishes. Since the abstracts are distributed to subscribers before the appearance of the complete papers, they serve for preliminary notices as well as for permanent records. Individual investigators may find them useful, and societies compiling bibliographies in these sciences would save themselves trouble and expense by taking the complete series.

The *Meteorological Magazine* for November states that forecasts can be obtained by communication with the Meteorological Office by telegraph or telephone to cover a period of twenty-four hours, also the state of the weather in various parts of the United Kingdom or the Continent. The Office is open day and night, including Sundays. The discussions of recent work of foreign meteorologists held at the Meteorological Office, South Kensington, which take place fortnightly during the winter months, and have continued since 1905, are now noticed in the magazine, and, indeed, for the first time in the public Press. The opening discussion this season was on "New Methods of Forecasting," based on two papers by Prof. Bjerknes. A record of 35,030 metres (22 miles) was alleged to have been established by a balloon at Pavia on December 7, 1911, but doubt is now thrown on the results, and it is suggested that the barograph was not working properly, which renders it probable that the greatest height attained was 18,900 metres—little more than one-half of the alleged height.

A new geographical journal has appeared in Italy. *L'Universo* is published every two months by the Istituto Geografico Militare in Florence, and is devoted mainly to researches in astronomy, geodesy, and cartography, but contains several articles on regional geography. The issues which have appeared maintain a high standard, and are well illustrated with plates and coloured maps. An article in No. 2 (March–April) gives a useful account of the Topographical Service of the Turkish Empire, and is illustrated with specimens and keys of the maps of various scales.

The Meteorological Service of the Dominion of Canada is issuing a series of monthly weather charts. Each chart shows the mean temperature, the difference from the average mean temperature, and the total precipitation of the month throughout southern Canada. The highest and lowest temperatures at various stations are given in tabular form. Weather and agricultural reports for nearly 100 stations are added. There are also notes on the probability of gales on the Great Lakes in the month of publication.

The problem of determining the forces which will act on a part of an actual aeroplane when in flight by observations on a model in a wind-tunnel is a very difficult one. An attempt at a solution of part of the problem has been made at the Bureau of Standards at Washington by Mr. H. L. Dryden, to whose work Scientific Paper No. 394 of the Bureau is devoted. By measuring the distribution of pressure on the surface of a cylinder with its axis at right angles to the wind-stream in a tunnel, Mr. Dryden shows that the decrease of pressure at the back of cylinders of small diameter is greater in proportion than the increase in front, and that, in consequence, the distribution of velocity is not similar about cylinders which are "dynamically similar"—that is, for which the product of the diameter, the speed, and the reciprocal of the dynamical viscosity of the wind has the same value. After showing that the size of the wind-tunnel, the effects of the guards, and of the gap between them and the cylinder cannot explain the difference, Mr. Dryden concludes that it is due to some unknown property of the air in the vortex motion behind the cylinder. He proposes to test this by taking photographs of this portion of the moving air.

THE second Report of the British Scientific Instrument Research Association, covering the work of the association from July 1, 1919, to June 30, 1920, is interesting reading. It is a striking example of the importance of applying scientific research and knowledge to the comparatively small things in life. The staff of the association, whilst preparing for a number of important researches, has been carrying out a series of investigations which, whilst small in themselves, are of importance to the scientific instrument industry. A polishing powder and some abrasives have been developed which have desirable properties, and which, it is hoped, will be manufactured commercially in this country. A research into tissue-papers has resulted in a specification which will enable opticians to obtain paper in which optical glass may be wrapped without tarnishing the glass. The association has produced a solder, fusing at a temperature of 195° C., capable of being used with aluminium, and this in itself is no small achievement. The report impresses the reader that every effort is being made to get into close touch and co-operation with other research organisations, such as the National Physical Laboratory, and at the same time the requirements of the users of scientific instruments are being continually studied. The future work of the association will be eagerly awaited by all makers and users of scientific instruments.

THREE papers on notched-bar impact tests were read at the Institution of Civil Engineers on November 30. The paper by Messrs. T. E. Stanton and R. G. C. Batson gives particulars of a series of tests made at the National Physical Laboratory with the view of investigating (*a*) the effect on the work of fracture and the consistency of the results obtained of a variation in the angle and sharpness of the notch in 10 mm. by 10 mm. specimens, and (*b*) the sensitivity of the various types of **V** notch in revealing faulty heat treatment. It was found that the shape of the bottom of the notch has an important effect, and the work of fracture has least value when the angle at the bottom of the notch is as nearly zero as can be obtained. Variations in the results of individual tests are not inherent in the method of test, but are due to a lack of homogeneity in the material. M. Charpy has found that by taking extraordinary care in heat treatment to ensure homogeneity it is possible to obtain a degree of uniformity in the results of notched-bar tests which is higher than any other mechanical test to which the material can be subjected. The National Physical Laboratory tests indicate that the 10 mm. by 10 mm. specimen developed by the Aeronautical Inspection Directorate, having a 45° notch with a radius of 0·25 mm. at the bottom, is as effective in the detection of faulty heat treatment as the Charpy specimen. Other tests on the dimensional effect with specimens of varying sizes indicate that the value of the impact test, as at present understood, lies not in discriminating between the impact resistances of different materials, but as a means of ensuring that the impact strength of any given material is at its highest. The paper by Messrs. R. H. Greaves and H. Moore also deals with notch radii, and that by Messrs. R. M. Jones and R. H. Greaves discusses tests made with the view of investigating the effect of overstrain.

THE use of wire-rope conveyors of the class having more than one rope has hitherto been restricted. This is owing to the fact that it has been the practice to attach the ends of the slats or their mechanical equivalents to separate ropes. Since it is not possible to splice separate endless ropes so that they shall all be of exactly the same length, strains are set up in the working which are fatal to success. This objection has been obviated in the Roe cable conveyor—described by Mr. G. F. Zimmer in *Engineering* for November 19—by fixing one end only of the slats or transverse carrier-bars to one endless rope, and the other end merely rests upon the other rope or ropes without being attached thereto. Thus two or more endless ropes of differing lengths may be used to provide a satisfactory support for the conveyor slats. In the conveyor illustrated in the article the total length is 1800 ft., and the difference in altitude between loading and unloading points is 15 ft. Ten brake-horse-power is required to drive the conveyor under full load at 150 ft. per minute. It is of interest to note that the invention owes its existence to the requirements of the War Office.

SOME particulars of the canal now under construction by the Hydro-Electric Power Commission of Ontario, Canada, are given in *Engineering* for December 3. The canal, which is said to be the largest for water-power purposes in North America, is about 8·5 miles long, and involves the removal of about 19,000,000 cubic yards of earth and rock. Water will be taken along the Welland River for about 4·5 miles from Chippawa, and thence through the canal proper to Queenston at the edge of the cliff marking the limit of the Niagara River Gorge. The power-house will be located at Queenston, where the net head available will be 305 ft. The actual difference in level between Lakes Ontario and Erie is 326 ft., and the present power plants at Niagara utilise heads of 150 ft. to 200 ft., which is the height of the falls alone. The additional fall in the new scheme is obtained by using a site beyond the rapids. The canal is designed to carry sufficient water to generate more than 400,000 h.p.

THE Journal of the British Science Guild for November contains an account of the annual meeting held in June last, when addresses were delivered by Lord Sydenham (the retiring president), Lord Montagu of Beaulieu (his successor), and others. Since then the Guild has lost by death its founder, Sir Norman Lockyer, and a past-president, Sir William Mather. In the account of the administrative activities of the Guild attention may be directed to the contribution by Dr. J. W. Evans, chairman of the Committee on the Utilisation of Science in Public Departments. Some interesting evidence of the results of undue centralisation in various Departments has been collected, and the need for a Royal Army Scientific Corps, with which should be associated a special research institution, is strongly emphasised. It is interesting to observe that the Admiralty now possesses a Scientific Research Department, and a specially contributed account of this new organisation appears in the Journal. Among recent papers on the Guild's objectives reference may be made to "The Human Factor in Industry," by Mr. Alexander Ramsay. An account is given by Prof. C. S. Myers of the work of the Institute of Industrial Psychology, which he represents as a *liaison* member on the Guild's executive committee. It is stated that the catalogue of British scientific and technical books in preparation by the Guild is now complete, and contains about 6000 titles. The scheme of forming provincial groups of the Guild appears to be making progress, the first local committee having been already set up in Aberdeen, with Prof. Alex. Findlay as secretary.

A COMPREHENSIVE and valuable catalogue (No. 408) of works relating to South Africa has just been circulated by Mr. F. Edwards, 83 High Street, Marylebone, W.1. It contains upwards of 700 titles. Many of the volumes are rare and difficult to obtain. Among the items offered for sale is the Godlonton correspondence—Sir Harry Smith: "A Collection of Fifty-one Autograph Letters, Signed, to the Hon. R. Godlonton," mostly marked "Private" or "Confidential," and wholly unpublished. The catalogue is one to be seen by librarians and others interested in the development of South Africa.

PROF. J. F. DOBSON, professor of Greek in the University of Bristol, and Dr. S. Brodetsky, lecturer in applied mathematics in the University of Leeds, have nearly completed their translation of the "De revolutionibus orbium celestium" of Nicholas Copernicus. The translation will be accompanied by a Life of Copernicus and some account of his influence and the history of the views connected with his name.

Our Astronomical Column.

TIDAL FRICTION AND THE LUNAR ACCELERATION.—Mr. G. I. Taylor contributed a paper to Phil. Trans., A, vol. ccxx., on tidal friction in the Irish Sea, from which it appeared that fifty Irish Seas would provide sufficient dissipation of energy to account for the secular acceleration of the moon. Dr. H. Jeffreys returns to the subject in Phil. Trans., A, vol. ccxxi., examining the various seas where such action is probable, and obtaining details of tides and currents from Admiralty publications. The seas that contribute most are largely enclosed, but an opening is required sufficient to admit the tide. The Mediterranean, Red, and Baltic Seas are thus excluded. Bering Sea is by far the largest contributor. It is concluded that two-thirds of the total action takes place there. The Yellow Sea, Malacca Strait, and the American North-West Passage come next. The famous tides of the Bay of Fundy contribute somewhat less than the Irish Sea.

The total rate of dissipation of energy is $2{\cdot}2 \times 10^{19}$ ergs per second. Taking the excess of the moon's secular acceleration above the portion due to diminution of eccentricity of the earth's orbit as 9″ per century per century (equivalent to 4½″ on the usual erroneous method of measuring by space gained instead of velocity gained), the equivalent dissipation is $1{\cdot}4 \times 10^{19}$ ergs per second. It is noted, however, that several of the data used were spring-tide values. Allowing for this, the agreement is quite as good as could be expected. It is the first time that a satisfactory estimate of the tidal friction has been made, and the author notes that it seems capable of satisfying all the quantitative demands made on it. He had previously expressed doubts on this point, but he had not then realised that the land-locked seas, not the open ocean, were the chief contributors.

Dr. Jeffreys also notes that the diurnal tides have a slight effect on the obliquity of the ecliptic, reducing it to $1/e$ of its original value in about 10^{10} years. The effect within historic times would be quite inappreciable.

THE SOLAR SPECTRUM FROM 6500 Å. TO 9000 Å.—Vol. vi., No. 3, of the Publications of the Allegheny Observatory contains an investigation of the red and infra-red region of the solar spectrum made by Mr. W. F. Meggers using plates stained with dicyanin and a large plane grating lent by the Johns Hopkins University; it was ruled by Prof. J. A. Anderson, and has 15,000 lines to the inch. The spectra of the opposite limbs of the sun were photographed in juxtaposition, the Doppler effect thus produced serving to distinguish solar and telluric lines. A large number of the latter are assigned (some tentatively) to water-vapour. The region 6500 to 7300 overlaps Rowland's table, the two tables being printed side by side. This region contains 473 solar lines and 596 telluric lines, while the region 7300 to 9000 contains 495 solar and 838 telluric lines. The infra-red spectra of many of the elements are still uninvestigated, but more than half of the solar lines in this region have been identified. In particular, the evidence for the presence of potassium in the sun is strengthened; besides the line at 4044 already known, lines are found at 7664 and 7699. The former partly overlaps a strong line in the A band of oxygen (telluric), but the Doppler effect permits it to be seen separately. There is a general absence of elements with high atomic weights; in explanation of this a sentence is quoted from Abbot's "Sun" (p. 253) stating that these elements would probably lie at too low a level for their lines to be seen at the limb. Seven elements (rhodium, ruthenium, palladium, gallium, europium, helium, and oxygen) are added to the thirty-six solar elements in Rowland's list. Oxygen is shown by the lines 7771, 7774, 7775, and 8446 (doublet); these lines have Doppler displacements.